Perception of e-mail personality at zero-acquaintance: Extraversion takes care of itself; Neuroticism is a worry

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Abstract

We investigate the impact of computer-mediated interaction on person perception. In particular, we study how traits important for socialisation and collaboration—Extraversion and Neuroticism—can be detected from the text of an e-mail communication. We have previously shown how Extraversion influences people's language production in electronic communication, in broadly intuitive ways. Here, we briefly outline the ways in which Neuroticism is expressed more through the high-level properties of a text. By their nature, these properties are less accessible to intuition. In subjective ratings of the texts for personality, we demonstrate that author Extraversion can be accurately perceived, given the limited cues, and that judges also exhibit relatively high agreement with each other for this trait. Neuroticism, however, appears more difficult. This result is consistent with previous findings, but suggests that e-mail exacerbates this discrepancy.

Introduction

One view of human cognition is that it has been shaped by natural selection to enable individuals to interact effectively with members of relatively large groups of peers: to estimate the trustworthiness of strangers, to recognise individuals, and to recall our judgement of familiars.

Until relatively recently, interaction has been conducted entirely face-to-face, or at least synchronously. It is therefore unsurprising that in such contexts, we are highly effective at judging people's characteristics, such as familiarity, gender, emotion or temperament (eg. Cheng, O'Toole, and Abdi, 2001). But technology now mediates much communication. Phone, e-mail or video-conference: in each case, people must make do with impoverished cues to help them estimate other people's emotional states, dispositions and personalities. E-mail is especially popular: it is designed to allow asynchronous communication; and it is often the means by which people make first contact with one another (Baron, 1998). Given this, it seems reasonable to ask: How easily can the personality of an author be perceived from their e-mail message?

To address this question, we here focus on the personality dimensions of Extraversion and Neuroticism. The rest of the paper is therefore structured as follows. We first describe the notions of Extraversion and Neuroticism with which we are working. We then briefly survey previous findings on perception of personality, before noting particular findings concerning the effects of technological mediation on personality perception. We note the objective features of text in our e-mail corpus that vary with Extraversion and Neuroticism, and then describe the methods and results of our perception study. The discussion section focuses on why Extraversion may be easier to detect in e-mail than other personality characteristics, like Neuroticism.

Background

Two personality traits

Extraversion and Neuroticism are traits which are considered central to theories of personality. They are common to the two major theories: Eysenck's three factor model (Eysenck and Eysenck, 1991); and the five factor model developed by Costa and McCrae (Costa and McCrae, 1992) and others. Beyond these two traits there is greater dispute, with personality described either in terms of the single trait Psychoticism, or divided into Conscientiousness, Agreeableness and Openness.

Extraversion is a trait strongly related to interpersonal interaction and sociability. High Extraverts are said to: be sociable, take chances, be easy-going and optimistic. Low Extraverts (or Introverts) are said to: be quiet, reserved, plan ahead, and dislike excitement (Eysenck and Eysenck, 1991). Unsurprisingly, then, there is popular awareness of this trait, and its manifestations in behaviour.

Neuroticism is generally related to internal emotional states. High Neurotics are said to be: anxious, worrying, over-emotional, and frequently depressed. Low Neurotics are said to be: calm, even-tempered, and unworried (Eysenck and Eysenck, 1991). Although internal states are less directly perceived than interpersonal behaviour, there is also considerable popular awareness of this trait, and it makes a real difference to productivity, collaboration, and performance in jobs requiring interpersonal interaction (Mount, Barrick, and Stewart, 1998).

Perception of personality

How much about ourselves do we give away in interaction? How good are other people at picking it up? From a cognitive science point of view, we need to know what aspects of interactive behaviour can be informative, before we design models of the relevant information processing. In fact, we must turn to social and personality psychology for the appropriate empirical methods.

Personality judgement data can be gathered in several ways. On the one hand, subjects' self-reports of personality, together with ratings of subjects by peers (such as spouses or colleagues), have been compared with each other for agreement. On the other hand, strangers have been called upon to make personality judgements, after being exposed to various different kinds of information about the target individuals. Funder's (1995) Realistic Accuracy Model views accuracy of judgement as a function of the availability, detection, and utilisation of relevant behavioural cues. The first two categories he describes as 'good judge', and 'good target': some people are better able to judge—or rate—personality; and some individuals are more easily judged than others. Generally, these kinds of variation do not appear to occur systematically across groups. However, other variation, labelled 'good trait' and 'good information', is more systematic.

Good Traits Distinguishing between the different personality dimensions has shown that, even in judgements by close acquaintances, much greater agreement is found for ratings of Extraversion than for Neuroticism (or Psychoticism) for the EPQ (Gomà-i-Freixanet, 1997), and this pattern has been mirrored in the five factor model (McCrae and Costa, 1987). Additionally, self-ratings were shown to be more informative in predicting behaviour for Extraversion—but not Neuroticism. Funder (1995) proposes that this is due, in part, to the 'visibility' of Extraversion. It is realised in 'frequent positive social interaction', whereas Neuroticism is realised via internal states. Furthermore, Neuroticism is regarded as more 'evaluative', ie. affectively charged. It may thus lead to: the concealment of undesirable behaviour from observers; or a distortion of self-perception, leading to lower target-judge agreement; or a greater reluctance to pass judgement on such behaviours, leading to reduced inter-judge agreement. When less evaluative measures of Neuroticism are used, agreement increases (John and Robbins, 1993).

Good Information The amount and relevance of target information available to the judges influences their agreement. Close acquaintances agree better with each other and with the target, than do relative strangers, although both predict target behaviour equally well, when they know the target in a relevant context (Colvin and Funder, 1991). Judgements by close acquaintances (especially when taken as a composite measure) generally also better predict target behaviour (Kolar, Funder, and Colvin, 1996). At the other extreme, studies have investigated personality perception of strangers on the basis of minimal cues, at so-called *zero-acquaintance*. Here there appears to be interaction between the available information and the visibility of the trait being judged. Albright, Kenny, and Malloy (1988) found that, on the basis of physical appearance, Extraversion and Conscientiousness could be reliably rated, although the former appeared to be mediated by judgements of physical attractiveness. On the basis of transcribed interactions, self-other agreement has been found for ratings of Extraversion (and also its opposite Introversion) (Gifford and Hine, 1994).

Technology mediated communication

Whether or not subject and judge have prior knowledge of each other, technology has an impact on what information is available in a communicative situation. Zero-acquaintance judgements are perhaps particularly vulnerable to technological artifacts. For example, interviews conducted over the telephone were found to result in reduced self-interviewer and peer-interviewer agreement than face-to-face interviews (Blackman, 2002).

In a computer-mediated environment (CMC), the cues are reduced even further, and following one-on-one interactions in an internet chat room, consensus was found between judges for a target's Extraversion, Agreeableness, and Openness, whilst target-judge agreement was only found for Extraversion and Openness (Markey and Wells, 2002).

Impressions of personality formed following task-oriented synchronous computer-mediated communication found that they were less detailed but more intense compared with those from face-to-face communication. Specifically, in the CMC environment, judges seemed less able to rate their partners for Extraversion, Neuroticism, and Agreeableness. Across both environments, Conscientiousness, Agreeableness, and Extraversion were the most rateable (Hancock and Dunham, 2001).

Linguistic features of personality

By analysing our personality e-mail corpus, we have previously shown that Extraverts and Introverts produce characteristic language features (Gill and Oberlander, 2002). For a summary, see Figure 1.

These results are broadly consistent with—and in some cases more detailed than—the prior literature (eg. Nass, Moon, Fogg, and Reeves, 1995; Furnham, 1990; Berry, Pennebaker, Mueller, and Hiller, 1997). In particular, study of texts *written* about thoughts and feelings by Extraverts has found that they used fewer negations, tentative words, negative emotion words, causation words, inclusive words, and exclu-

Surface Realisation Extraverts are more informal, use *hi*, and use looser punctuation (*!! or ...*). Introverts use *hello*.
Quantification Introverts show greater use of quantifiers (*for exaggeration?*); Extraverts are looser and less specific.
Social Devices Stylistic expressions such as *catch up* and *take care* indicate the Extravert's relaxed social style.
Self/Other Reference Introverts use more first-person singular (*i*), whereas Extraverts are more likely to use plural *we*.
Valence Introverts prominently use negations; Extraverts use words suggestive of positive affect.
Ability Extraverts are more confident and assertive (eg., *want-, able-, need-(to)*); Introverts are more tentative and timid (*trying-, going- (to)*).
Modality Extraverts are more strongly predictive than Introverts (eg., modal auxiliaries *will- vs. should- (be)*).
Message Planning/Expression Introverts prefer coordinating conjunctions (*and, but*), whereas only Extraverts use the subordinative *which* (*usually for evaluation?*).

Figure 1: Extravert and Introvert Language

Table 1: Summary of LIWC, MRC, and TTR multiple regression analyses.

Analysis	Independent Var.	β	R^2	p
LIWC	Inclusive Words	.28		
	Total First Person	.21	**.11**	**.0030**
MRC	Mean Concreteness	.33		
	Mean Brown Verbal Frequency	.27	**.14**	**.0004**
TTR	10 Word Measures	−.27	**.07**	**.0057**

Note: In each case, EPQ-R Neuroticism Score is the Dependent Variable. LIWC = Linguistic Inquiry and Word Count; MRC = Medical Research Council Psycholinguistic Database; TTR = Type-Token Ratio.

sive words, while using more social and positive emotion words (Pennebaker and King, 1999).

Extraversion is generally considered most relevant to communication, but Neuroticism also has implications for interaction (Mount *et al.*, 1998). Furthermore, Pennebaker and King (1999), using the Linguistic Inquiry and Word Count (LIWC) text analysis program, showed that broad psychological language categories are related to Neuroticism. For example, they found that when writing about thoughts and feelings, high Neurotics use more negative emotion words and fewer positive emotion words, along with other features in their factor 'Immediacy'.

Using multiple regression analysis, we have uncovered characteristic language usage patterns for Neuroticism in our e-mail corpus. Table 1 shows the results of these analyses, using LIWC data (Pennebaker and King, 1999), psycholinguistic properties from derived from the Medical Research Council (MRC) Psycholinguistic Database (Wilson, 1987), and a measure of lexical diversity, type-token ratio (TTR) (Bradac, 1990). (See also Gill and Oberlander, prep, for more details.)

We would expect a text characteristic of high Neuroticism to exhibit the following: In terms of LIWC features, we would expect words such as *with, and, include* (indicating inclusion) to be used, which are possibly indicative of the high Neurotic's desire for attachment or reassurance; first person pronouns, such as *I, me, we* again indicate a preoccupation with self, and may be related to our previous findings for low Extraverts (Introverts).

This relationship between Neurotics and Introverts again appears in an increased use of concrete words (for entities which can be sensed); for example, *table, spoon, girl*, rather than abstract words, like *thoughts, flavours, pains*. Given the relationship between Neuroticism and Brown Verbal Frequency, we suggest that high Neurotics show a preference for forms occurring frequently in speech, for example, *I, and, that*, rather than less common words such as *abject, suspicion, tether*. This preference for common words contributes towards the very low lexical density found in highly Neurotic texts, demonstrated by the high repetition over ten-word sections of text.

So, e-mail from Extraverts and Neurotics has characteristic linguistic features. Do judges with zero-acquaintance pick up on these features? We turn now to our rating experiment.

Method

Participants

The 30 judges were current students at the University of Edinburgh, or recent graduates (15 males, 15 females; mean age= 21.6 years, s.d.= 1.24). All were highly experienced e-mail users (rating themselves between 7 and 10 on a scale of 1–10; mean= 9.23, s.d.= 0.77), and naive raters of personality (none had previously taken part in personality rating experiments, although 3 had studied Psychology as part of their course). Participants received a nominal 'experimental expenses' payment for taking part.

Materials

Selection of Target Texts The target e-mail texts were selected from data previously collected (see Gill and Oberlander, 2002, for further details). These texts were composed 'to a good friend' to ensure they elicited a naturalistic expression of personality. Only the 105 'past' texts, detailing recent activities, were considered since these were generally slightly longer (each approximating 10 minutes of written communication; cf. Blackman, 2002). Six texts were chosen to represent a range of scores from the Extraversion, Neuroticism, and Psychoticism dimensions. Extreme high and low personality scores were deemed to be those greater than 1 standard deviation of the mean (Dewaele and Pavlenko, 2002), and two texts represented each of these. Additionally, two further texts were selected—one above and below the mean—to represent less extreme realisa-

tions of the trait (each between .5 and 1 s.d. of the mean). In each case, the scores for the other personality dimensions were controlled for, being $< \pm 1$ s.d. of the mean (in most cases $< \pm .5$ s.d.). This resulted in 6 texts for each dimension. Each e-mail text was anonymised by name substitution before use in the experiment.

Subjective Rating Methods Descriptions of the personality dimensions were presented to the participants before rating of the e-mail texts. These were taken from Eysenck and Eysenck (1991) (with minor re-wording to enhance general intelligibility), and participants were informed that they could refer back to them at any point during the experiment. Although it is more usual to rate personality using a standard set of personality questions, Sneed, McCrae, and Funder (1998) have found that 'most laypersons can easily grasp the nature of the factors and their behavioural manifestations and can spontaneously recognise their grouping when presented with clear exemplars'.

Each text was followed by a set of questions, with answers rated on a scale of 1–10, as follows. (i) How Extravert (or Emotionally Stable, or Tough-minded[1]) is the author of the e-mail? (ii) How easy was it to judge the author's personality? (iii) How informative were Topic, Vocabulary, and Style in judging personality? (iv) How similar is the author's personality to your own? Finally, subjects supplied 5 words describing the author's personality.

Procedure

Upon commencing the experiment, subjects were given a rating booklet prefixed with written instructions explaining that the experiment was investigating how author personality can be perceived through e-mail texts. It was emphasised that they should answer honestly and accurately, not spend too long thinking about each question, and instead concentrate on giving their initial response.

The target e-mail texts (described above) were then presented in random order within their representative dimension. Each set of dimension texts (P, E, or N) were presented using a Latin square technique to avoid ordering effects.

Following the rating of the texts, participants were asked to confirm that they are Native English Speakers, detail their experience of personality psychology, and rate their previous experience using e-mail. Participants were then asked to complete EPQ-R and NEO-PI personality questionnaires (both short forms), before being debriefed about the experiment.

[1]The terms 'Emotional Stability' and 'Tough-mindedness' have been used in preference to Neuroticism and Psychoticism when discussing these traits with participants (cf. Eysenck and Eysenck, 1991).

Table 2: Summary of inter-judge agreement.

Trait	Target-rater	Inter-rater	
	Aggr. r_s	Mean r_s	s.d.
Extraversion	.89*	.48	.17
Neuroticism	−.29	.31	.16

Note: Target-rater = correlation of target self-reports and rater judgement; Inter-rater = correlation of rater judgements with each other. Aggregate correlation is calculated from 30 raters. Mean r_s is the mean correlation across all raters. $^*p < .05$, two-tailed.

Table 3: Summary of similarity ratings.

Rater group	High trait texts			Low trait texts		
	n	U	p	n	U	p
High E	42			42		
vs **Low E**	47	647	.005	47	941	.702
High N	33			32		
vs **Low N**	56	813	.341	57	732.5	.121

Note: Observations (n) vary due to missing cases.

Results

For clarity here we discuss only the results for texts contrasted on the Extraversion and Neuroticism scales, and we focus on the subjective ratings and similarity ratings for these texts. Spearman correlation of target personality scores and subjective ratings aggregated across the 30 judges is shown in the second column of Table 2. Inter-rater agreement, and standard deviation, are shown in the following columns; these are calculated from the mean of each rater's mean Spearman correlation with each of the other raters. Since this is a mean correlation, no significance value is shown. For a description and discussion of further results, see Gill and Oberlander (2003).

Table 3 shows the Mann-Whitney U-tests (two-tailed) calculated from the similarity ratings for the judges grouped by High and Low Neuroticism and Extraversion for the texts grouped by these categories. Examination of the means for the High and Low Extraverts rating High Extravert texts, shows that the High Extraverts do indeed rate themselves as significantly more similar (5.71; s.d.= 1.92 vs 4.65; s.d.= 1.89).

Although not significant, the next strongest difference is found between the High and Low Neurotic similarity ratings of Low Neurotic texts. Comparison of the means shows that it is the High—rather than Low—Neurotic raters who see themselves as most similar to the Low Neurotic e-mail authors (5.00; $s.d. = 2.17$ and 4.34; $s.d. = 2.09$, respectively).

Discussion

Before discussing the subjective ratings in detail, it should be noted that there is a much greater level of target-rater agreement, than inter-rater agreement, for judgements of Extraversion.

Part of this increased agreement for target-rater judgements can be explained by the use of aggregated scores across raters. This is because they may 'reflect more accurately the consensus of how an individual is viewed'. The high number of raters (30) for each target apparently contributes towards the good agreement (cf. McCrae and Costa, 1987). In fact, even without aggregation of judgements before correlation (ie. calculating the mean across each rater's correlation with the target), the same pattern is still preserved (mean r_s E= .64; N= −.02).

Subjective Ratings

In the case of inter-rater judgements, both Extraversion and Neuroticism show a level of agreement greater than .3, which is regarded as the lower level of acceptability within personality research (McCrae and Costa, 1987). In Neuroticism's case, this level is only just reached; by contrast, Extraversion shows much greater agreement between judges.

In the case of target-rater judgements, however, there is a greater discrepancy between the traits. Extraversion shows a strong, significant, positive correlation, while Neuroticism shows a relatively weak, non-significant, negative relationship.

Similarity Judgements

The similarity ratings show that only the High and Low Extraverts rate their similarity to the High Extravert texts significantly differently. This confirms the observability of Extravert behaviour—even in an asynchronous CMC environment. Furthermore, this also lends some support to Funder's (1995) claim that Extraverts may make more accurate judges of personality—at least for Extraversion.

The tendency of High Neurotic judges to rate themselves similar to Low Neurotic authors contributes further towards the confused picture that exists for ratings of Neuroticism. Indeed, it may well be the High Neurotic raters who are clouding the picture for ratings of Neuroticism as a whole.

Interpretation

Taking these results together, the picture for Extraversion seems relatively clear. There is a high level of agreement between judges, and the judges tend to agree with the targets themselves. It seems safe to conclude that writers of e-mail messages do betray their level of Extraversion through their linguistic choices; and readers of e-mail messages can reliably infer the author's level of Extraversion from the text alone. This supports previous findings from the literature for well-acquainted raters (Gomà-i-Freixanet, 1997; McCrae and Costa, 1987), zero-acquaintance raters (Gifford and Hine, 1994; Albright *et al.*, 1988), and in computer-mediated communication (eg. Markey and Wells, 2002).

In the rating of Neuroticism, there was a low but evident level of agreement between judges, but not between judges and targets. This follows a trend of lower agreement for Neuroticism than for Extraversion found more generally (Colvin and Funder, 1991; Kolar *et al.*, 1996). However, this lack of perception ability appears particularly acute for zero-acquaintance (Gifford and Hine, 1994; Albright *et al.*, 1988) or CMC (Markey and Wells, 2002; Hancock and Dunham, 2001). Indeed, the fact that raters agreed amongst themselves for the ratings of Neuroticism appears to mirror Markey and Wells's (2002) findings for Agreeableness, since despite inter-rater agreement, they were unable to find target-rater agreement. Since raters were in a cue-impoverished environment, this may have resulted in their relying upon cues—apparently stereotypical of the trait—but inappropriate (Scherer, 1972).

The similarity ratings confirm the observability of particularly high Extravert authored texts, and also point to the expertise of Extraverted raters. Both subjective and similarity results for Neuroticism point to confusion on the whole, and possible distortion of this trait on the part of high Neurotic raters (Funder, 1995). Given the findings of John and Robbins (1993) regarding the role of evaluativeness in the assessment of this trait, caution may be advisable in the subjective personality rating of Neuroticism (note, however this effect was not present for another highly evaluative trait, Psychoticism; cf. Sneed *et al.*, 1998).

To summarise the position on Neuroticism, we return to Funder's Realistic Accuracy Model. There is no reason to consider that we had bad targets on this dimension; deception would have been revealed in the EPQ-R Lie Scale. In general, we do not have bad judges; they agreed with targets and each other when rating Extraversion. It is however, possible that highly Neurotic authors linguistically conceal the full extent of their Neuroticism and this would tend to lower its visibility. This may have led to the confusion of highly Neurotic judges in ratings of similarity. So, in fact the main difficulty seems to be that Neuroticism is a bad trait. It is held to be high in evaluativeness, and low in visibility. Our study has provided evidence that the trait affects the form of the e-mail texts. But the evidence is in terms of the concreteness of language, or in repetitiveness. While these may cause unconscious reactions in judges, the latter appear unable—or unwilling—to recruit them in their judgements.

Conclusion

We have shown that at zero-acquaintance, people are able to take asynchronous communication, and are still able to subjectively rate the degree of Extraversion of the author. There is also a relatively high level of agreement between judges in rating the target. In the case of Neuroticism, raters show a reasonable level of agreement with each other, but their perceptions of Neuroticism do not appear to

match up with the targets' self reports. So the asynchronous nature of e-mail seems to exacerbate the differences in the perception of personality traits.

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